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ABSTRACT

This report explores the experiences and lessons learned by projects funded by the Telecommunications and Information Infrastructure Assistance Program (TIIAP). The report contains 11 stories about people who are working to ensure that technology enhances the lives of children. The stories are divided into five sections as follows: (1) "New Avenues for Artistic Expression," including the Vermont Millennium Arts Project and Zeum (California); (2) "Making Connections across Social and Geographic Boundaries," including Access for Better Crete (Nebraska) and Valley City (North Dakota); (3) "Kids Contributing to Their Communities," including Rogers and Holland Schools (Texas) and Tech Crews (Mississippi); (4) "Getting Ready for the World of Work," including Boston Public Schools (Massachusetts) and Corporation for Business, Work, and Learning (Massachusetts); and (5) "Helping Children Bridge the Digital Divide," including Plugged In (California), National Urban Technology Center (New York), and Laptop Kids (Minnesota). (MES)

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How Access Benefits Children:

Connecting Our Kids to the World of Information

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U.S. DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration

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How Access Benefits Children

Connecting Our Kids to the World of Information

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September, 1999

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DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA

PREFACE

It is my pleasure to introduce *How Access Benefits Children: Connecting Our Kids to the World of Information.* The report is the fifth in a series of reports from the National Telecommunications and Information Administration (NTIA) exploring the experiences and lessons learned by projects funded by the Telecommunications and Information Infrastructure Assistance Program (TIIAP). For the last five years, TIIAP has funded innovative demonstration projects that bring the benefits of emerging information technologies to public service organizations. Among their countless innovations, TIIAP grantees have reinvented how people learn, how patients obtain medical treatment, how children deal with the digital world, and how communities share information to enhance their quality of life.

How Access Benefits Children describes how our first digital generation is learning, playing, working, communicating, and becoming consumers. This new generation approaches information technologies differently. Recent research suggests that while many adults are adopting the Internet, young people are internalizing it. The distinction is significant: adults add Web use to their pre-existing routines and behaviors, while for many children, the Internet is fully integrated into their lives and affects the way they think. One implication of this finding is that this internalization of the 'Net will shape this generation's expectations as consumers. As *How Access Benefits Children* shows, the 'Net also may shape how this generation contributes to and relates to its communities.

Much popular media discussion today focuses on the dangers associated with children's access to the Internet. These concerns are serious and parents and communities need the tools to protect their children. However, the focus on potential dangers obscures the extraordinary value that access to the 'Net offers to our young. This report examines some of the benefits such access brings, not only to children and youth, but to their entire communities. These TIIAP-funded projects are demonstrating how access to the Internet creates opportunities to tap the creativity of children and youth, to nurture their artistic talents, to engage them in civic enterprises, and to create bonds across generations.

To find out more about the projects profiled, I encourage you to contact the people listed in the report and ask them about their experiences. They have much to tell us about how technology and the children using it are transforming all aspects of our society. Additional information on the TIIAP program and the projects is available from the TIIAP office and on the NTIA web site at: www.ntia.doc.gov.

Larry Irving
Assistant Secretary of Commerce
for Communications and Information

DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA

INTRODUCTION

Like most technological innovations, the Internet has spawned high hopes, but it has given rise to deep fears as well. Will the era of wide-open, instant communications enrich our lives, or will it overwhelm us? Will it create new opportunities for us to learn and grow, or will it leave us confused and lost amidst a cacophony of voices? Will it strengthen our communities, or will it leave us in disarray and subject to those who prey on the vulnerable and the isolated?

These questions are especially pressing when it comes to children. Some believe the Internet offers our kids unparalleled new opportunities to learn, to discover a world beyond themselves, and to form rewarding new relationships. But others fear that it tears down customary safeguards of family, community and trusted institutions, leaving children open to the influence of countless Pied Pipers.

Which vision will define our future? This report contains 11 stories about people who are working hard to ensure that technology enhances the lives of children. In their view, computers can, indeed, uplift our kids. With their help, young Americans are finding new ways to express themselves, forming relationships that have become increasingly difficult to find in today's fast-paced world, giving something back to their communities, and preparing for the future.

On top of all that, the people described in this report are committed to ensuring that the new opportunities unleashed by technology are available to all of our children, regardless of their economic status or station in life. Their efforts demonstrate that there is nothing inevitable about the digital divide.

All of the projects discussed here have received funds from the Telecommunications and Information Infrastructure Assistance Program (TIIAP). But these efforts do not originate in Washington. Rather, they arise from local communities throughout the country, and they demonstrate Americans' continuing belief in individual opportunity and expression, their faith in family, and their commitment to community. As long as we ensure that technology serves these values, there is good reason to believe that it will, indeed, bring our children a bright future.

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PART ONE:
NEW AVENUES FOR ARTISTIC EXPRESSION

THE VERMONT MILLENNIUM ARTS PROJECT:
LEARNING TO MAKE MUSIC ONLINE

"My name is Adam. I am a 12-year old seventh grader at North Country Junior High School. I am writing a piece of music in Performing Arts class. Everyone in my class is writing a piece in 4-4 time, but I chose to write mine in 3-4 time signature. I wrote the piece by thinking up an eight-measure musical phrase in my head. This first eight-measure phrase was kind of like a question. Then I made up an answer to the question..."

With these words sent by electronic mail from his school in isolated northern Vermont, Adam begins a dialogue with a professional composer, teachers, and fellow students scattered around the scenic Green Mountain state. Over the next few months, Adam's peers, teachers, and mentors will go to their computers to listen to his composition, which he entitles "Rondo," and to read his explanation of the creative ideas that lie behind it. Then, they will tell Adam how the piece affects them, respond to his questions about how to embellish his melody, and offer detailed suggestions – sometimes pinpointing specific notes they think should be changed. At one point, the professional composer even will compose a suggested revision and send it back for Adam to consider. Adam will incorporate many of his peers' and mentors' ideas into subsequent versions of the piece, and he will explain politely why he disagrees with others. Finally, he will announce that his labors are finished. Thanking his far-flung advisers, he will report that he is preparing to play the piece on a real piano in a recital, and he will invite others to do sc themselves.

As this real-life example illustrates, students like Adam are using computers to go where few students have gone before. Not only are they composing music, they also are sharing their work with their peers, their teachers, and professional mentors. Similar projects are harnessing computer networks to teach children the visual arts and creative writing. And soon, an ambitious undertaking known as the Vermont Millennium Arts Project will expand the number of students who can take such classes and extend on-line arts education to theater and dance as well.

Already, the results are astounding. Forget "Row, Row, Row Your Boat" or "Three Blind Mice." Vermont students are producing

The Vermont Millennium Arts Project
Project Starting Date:
October 1, 1998
Project Ending Date:
September 30, 2001
Total Project Cost:
$750,000
Federal Share:
$375,000

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original melodies, complete with complex rhythms and elaborate harmonies. Their pieces employ a range of instruments, and run the gamut from Adam's classical Rondo (his mentor notes similarities to Bach) to "War Games," an eleventh grader's suspenseful score for an action movie. These and other melodies like "Sweetness Rag," a three-part piece featuring banjo and harmonica playing a catchy tune one might hear at a Vermont country fair, are distinguished both by their originality and surprising sophistication.

"Some of the work these kids are doing is amazing," says Peggy Madden, a professional composer who corresponded with Adam. "And they continue to get more amazing: the kids come back and put up new compositions each year that are better than the ones they did before."

The Vermont Millennium Project demonstrates how computer networking is bringing unparalleled new opportunities to America's school children. But as with other technology projects, it owes its success to much more than technology. Teachers and other adults have devoted considerable time and care in planning how to use the new tools to enhance children's education, and they work closely with the kids who use them.

Adam and his peers use computer software called "Musical Instrument Digital Interface." MIDI, as it is known, can faithfully recreate the sounds of 128 different musical instruments. Students write their pieces with computers, moving their cursors to "write" notes on electronic sheet music. But unlike composers of old, they can listen at any point to what they have written. With instant feedback, students learn musical theory and notation.

The students generally compose in groups of two, three, or four – a requirement that leads them to learn music terminology so that they can communicate with each other. "We want the kids to talk about the work as they are creating it so that they learn the language of music," explains Sandi MacLeod, who teaches third, fourth, and fifth graders at Founders Memorial School in Essex Town, Vermont.

Communication beyond the classroom also is an essential part of the Vermont program. Students post their work on a website (**www.vtmidi.org**) where peers around the state, as well as music professionals, listen to it and react. But this is no free-for-all chat group. Teachers have carefully devised rules for critiquing student work, and participants in the on-line discussions are expected to be polite and substantive. "We're trying to create safe places within the discipline, where students can get a deeper understanding of their work," explains Dawn Ellis, director of education programs for the Vermont Arts Council.

Mentors play a key role in keeping discussions on a high level. Vermont selects its adult mentors carefully, both for their professional qualifications and their support for the teaching philosophy behind the project. It asks them to devote at least 2-1/2 hours a week reviewing and commenting on student work, or about an hour per composition. For this, they receive $3,000 per school year – certainly not a fortune, but enough to demonstrate that the participating schools are serious about the venture.

State officials are confident the expenditure is well worthwhile. Besides receiving professional advice, students get tangible proof that the school system takes their work seriously. "You can't imagine what it means to a student that a professional will look at his or her work – sit down and really work on it – for an hour," says William Hays, manager of the Millennium Arts project.

By all accounts, mentors find the work rewarding too. Most put in much more than the required 2-1/2 hours a week, Hays notes. For many, it is a labor of love. "When I go online and look at (student) art work, it is like having a museum walk through my house," says Heidemarie Heiss Holmes, a visual artist based in Montpelier, Vermont. She says the student art work offers her valuable insights into what children are thinking, and has made her feel a strong part of the Vermont community.

In the visual-art component of the Vermont project, students generally use traditional techniques to create paintings or sculptures, which then are scanned and posted on a website. Heiss can view these works on her computer, and send her comments. She also can electronically fetch digitized professional paintings and send them back to students as email attachments to illustrate her points. According to Heiss, the fact that she is not a classroom teacher and does not work directly with students is no problem. In fact, she says, it actually increases her effectiveness. "I have no relationship with the student, no history, so I can be completely objective," she explains.

The Vermont Millennium Project grew out of an earlier effort, called the Vermont Web Project, which was financed in part by the U.S. Department of Education. With TIIAP assistance, it plans over the next three years to increase the number of schools, mentors, and students participating in online arts education (currently, the project serves about 6,000 kids). While procedures for teaching music and the visual arts online are well established, project sponsors will be exploring less charted waters when it comes to dance and theater. Hays sees opportunities for extensive collaborations among Vermont schools, many of which have no theater facilities at all (55 schools in the state have fewer than 100 students). Students in various schools could work together to write scripts and design sets and costumes, he suggests. Then they could come together in a central location to produce plays. "Instead of a 'school' play, we'd have a 'schools' play," Hays says.

Dance poses bigger challenges, partly because the language of that art form is less well developed. But the Vermont arts community will also be exploring the possibilities in this arena. Computer-based animation presents some possibilities. Schools also could use the Internet to do simulcasts. Tools even exist to create "virtual performances." With one tool, for instance, dancers can wear "motion capture suits" that measure their movements and transmit them to computers where they show up as flashes of light on a screen (for an example, visit "Ghostcatching: A Virtual Dance Installation," on the Cooper Union School's website in New York (**www.cooper.edu/art/exhib.html**). Hays emphasizes, however, that project sponsors do not want to get carried away with technological razzle-dazzle. "We're looking for the highest lowest common denominator," he explains.

Still, the possibilities are breathtaking. Hays, a painter himself, says the project has given him new hope for the Internet as a tool for enhancing the arts. "Before I took this job, I was deeply disappointed in the use of the Internet in the arts," he says. "I saw tremendous potential for communication among artists and among people interested in the arts, but there wasn't much real exchange." Now, the outlook seems more encouraging. "This project will revolutionize arts education," he predicts.

ZEUM: *KIDS CREATING ART THROUGH TECHNOLOGY*

As most any parent can attest, kids love technology and the media. But when our children while away their time playing video games or lining up to see the latest animated adventure movies, many adults wonder: Can this really be good for them? Or will spending long hours passively engaged in a commercial fantasy world stifle creativity and imagination?

An exciting new institution in San Francisco offers an answer to such concerns. It invites kids to rise from their couches, break loose from the constraints of preprogrammed video games, and use the tools of digital media as vehicles for self-expression. It's called "Zeum," a high-tech museum for the digital era. But forget what you know about museums, art, and technology. From its location atop the Moscone Center's southern convention hall in San Francisco, to its unique name, Zeum is breaking the mold.

Part workshop and part museum, Zeum showcases new media tools, and invites kids to take charge of them. Visitors to the facility's exhibition gallery or to its 200-seat theater can see works created jointly by renowned artists and Bay Area teenagers. As these works demonstrate, Zeum draws its visitors into hands-on collaborations. It helps students create their own art using traditional or digital easels, clay-modeling tables, a puppetry room, a fully equipped movie production lab, or a computer lab with multimedia workstations. In the process, it increases students' understanding of the media that have become so much a part of their lives. And, perhaps more important, it shows them how to use these same tools to express their own creative ideas.

People who have seen the unique facility struggle for terms to describe it. Laura Evenson, a writer for the *San Francisco Chronicle*, put it this way: "Think of the Guggenheim Museum meets the Starship Enterprise, but on a smaller scale."

Consider some of its recent exhibits. "Tilt," which Zeum's sponsors describe as a "multimedia funhouse," takes "a fun look at the impact of technology and the media on our lives." Visitors enter through what looks like a large television screen, where they view a series of commercial spoofs created and acted by teens. Once inside the "television," visitors suddenly find themselves inside a milk carton. The only way out is to slide through the straw into a box of cereal. Other installations include an overloaded washing machine spinning off-balance, its buzzer blaring while the television bombards viewers with instant replays of the O.J. freeway chase. A dog's collar has a computer-generated voice, which interprets his barking as "Open the door and let me out!" These and other

Zeum
Project Starting Date:
October 1, 1997
Project Ending Date:
September 30, 1999
Total Project Cost:
$648,416
Federal Share:
$239,062

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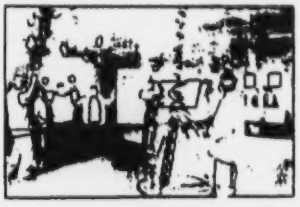
installations, sponsors say, "help reinforce the concept that our lives can be distorted by the media if we let it."

Another exhibit, "Zoetropia," presents modern artists' interpretations of one of the first mechanical devices used to make moving images. Zoetropes, precursors to modern motion picture cameras, are cylinders inside which artists place still photographs or drawings. By spinning the cylinders, the artists make the images appear to move. After viewing the exhibit, visitors can make their own motion-picture machines at a "Zoetrope Production Area."

In a third exhibit, "Unnatural Geographic," Zeum-goers enter a large, cylindrical room. By pushing different buttons, they unleash animated creatures, which fly or walk around the room. Bay Area teenagers used computer modeling to create the beasts in collaboration with resident artist Josh Rosenstock. In the process, they learned many of the same techniques filmmaker George Lucas used to make "Star Wars" movies.

While fun, all these pyrotechnics serve serious educational purposes. "Our goal is to bring art-making experiences, including use of new tools and old tools, to youth and teachers," says Marie Sayles, Zeum's education coordinator. Zeum aims at once to make youth more aware of the media-saturated environment in which they are growing up, to encourage self-expression, and to teach students technology skills that will serve them well in the job market.

Unlike video games, which are "closed structures," the software tools the youths use at Zeum allow kids to be "creators of content," Sayles notes. A three-dimensional modeling package, for instance, allows the user to animate



figures. He or she sees on the computer screen a picture of a person, and can click on different body parts to move them. By defining different movements – the swing of the head or arms, for instance – the user can explore how body movements express character. Another tool allows Zeum visitors to manipulate digital photos, changing coloring, adding or removing elements, putting in titles, and more. And then there's stop-action video, a technologically simple process that allows students to create motion pictures using clay figures or other materials.

This may sound like play, but it's hard work. "This is a museum that requires time, commitment, and a serious attention span," says Laura Reiley, a writer for the *Palo Alto Weekly*. Zeum places high expectations on its student interns who work with artists to produce special exhibits, paying them for their services. Teenagers also serve as docents (although, as one might guess, they go by another name – "Zeum masters"). All of this can help build self-esteem among kids. Even youthful visitors get a boost from seeing sophisticated multi-

media art devised done by their peers. "Teenagers are very excited to learn that the work was created by people their own age," says Rosenstock.

To strengthen its educational mission, Zeum and a group of private partners joined with TIIAP to establish high-speed connections between the institution's production lab and a group of six area elementary and secondary schools. Each school received a "digital toolkit" consisting of an audio-visual camera, a Hi-8 camera, a digital camera and a digital audio tape-recorder. Students use these tools to collect images, sound clips and video clips from their communities. Then, they send these materials via the Internet into the Zeum, where they produce their own movies or other art works.

Though Zeum only opened in October, 1998, the effort already has spawned a number of school projects. High school students from one school produced video clips, claymation, and other presentations based on the myth of Persephone and Demeter. Other high-schoolers used digital cameras and computers to create their own CD covers. A group of middle-school students with special learning challenges wrote and illustrated stories about dreams. Fourth graders from a culturally-diverse school collected information on their native cultures and compared them to their lives in San Francisco; these same students took the digital cameras and a laptop computer with them on a week-long field trip to the Tuele River Indian reservation in central California, reporting back to their classmates on the school webpage.

"This is changing everything I do in the classroom," says Phil Nelson, an elementary school teacher at Harvey Milk Civil Rights Academy. "I had students who couldn't care less about anything, but now they are so excited about Zeum."

Students are learning faster, and parents – many of them recent immigrants – have started showing up at school to see what has made their kids so enthusiastic, Nelson says. Of course, some parents have no choice: their kids want to be driven to school so they can arrive before the school bus does – and thus get some time on the computer before classes begin.

PART TWO:

MAKING CONNECTIONS ACROSS SOCIAL AND GEOGRAPHIC BOUNDARIES

ACCESS FOR BETTER CRETE:
BRIDGING THE GENERATIONS IN RURAL NEBRASKA

Kids have an insatiable appetite to learn about their world, but all too often they are isolated from their communities, with little opportunity to interact with people who are not their own age. In Crete, Nebraska, schools, local government and a social services agency are using technology to help children connect with another isolated group – senior citizens. In the process, the kids are learning a lot about their community and its history.

The concept was simple: project sponsors deployed computers in schools and nursing homes, and then linked senior citizens and school children as email pals. Soon, the two generations were comparing notes on topics ranging from hobbies to allowances, teaching each other what is similar and what is different about growing up in the 1920s or 1930s and the 1990s.

"It was apparent, even in the first few weeks of the project, that the kids were wanting to know more about the residents, and that they were amazed by some of the stories being told," wrote Ann Moser and Joel Shoemaker, two college interns who helped with the project. "Likewise, it was good for the seniors to learn some of what it is like growing up in the 90s. These two groups (previously) had no outlet in which they could receive this kind of learning."

"Access for a Better Crete," or ABC, as the project is known, is a cooperative effort involving the City of Crete, Crete Public Schools, Blue Valley Community Action, Doane College, and Cable Vision of Lincoln. With assistance from TIIAP, the partners created a fiber-optic network linking the Crete School District and several other major public institutions in the community. Then, they placed computers providing access to this network at the Crete Senior Citizens' Activity Center, Crete Hospital, Crete Manor Nursing Home, Garden Square Elderly Assisted Living Center, Crete Physicians Clinic, the East/West Meadows low-income housing project, and several other locations.

While designed especially to connect children and seniors, the project reaches out to other isolated groups as well. Students with Spanish and Portuguese backgrounds also participate, as do

Access for a Better Crete
Project Starting Date:
October 1, 1996
Project Ending Date:
September 30, 1998
Total Project Cost:
$530,727
Federal Share:
$240,911

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adults working to get GED diplomas in the "Even Start" program. Student interns like Moser and Shoemaker have played an important role in training users and testing some of the project's more exotic equipment – including computer devices that can translate sentences typed in Spanish into spoken English or vice versa, and a software program that enables people who cannot use a computer keyboard to move a cursor and write by blinking their eyes.

All these groups are linked to each other and mainstream Crete society, partly through an electronic community bulletin board carrying a community calendar of events, civic group schedules and information about service organizations and local businesses. Much of the information on the bulletin board was collected by kids: during summer webpage-building classes involving students from ages 10 to 18, students were assigned business and civic groups to contact for information to put on the Crete homepage. At first, the students were shy in contacting adult business people for information, but with time they gained confidence and began making contacts on their own time outside of class, according to Sandy Rains, the ABC Project Director.

Of all the various community-building efforts, the e-pal project generated the most excitement. Teachers said the project offered a unique opportunity to bring history to life for their students. In one email exchange, for instance, fourth graders named Travis and Kyle described their two favorite vacation trips – to the Minnesota Mall of America and skiing in Colorado. In response, a nursing-home resident described her experience driving with her family from Springfield, Missouri, and Texarkana, Arkansas, to Estes Park, Colorado, for summer vacation. "Driving in the 1920s was very different from what it is now," the senior citizen said. "Highways, with very few exceptions, were not paved; highway signs were painted on telephone poles – OT for Ozark Trail brought us through Missouri. Our Studebaker was an open 'touring car' with side curtains – mostly cloth with primitive plastic windows so one could see out. The side curtains were left rolled up by the rear window – except when it rained. And when it did, we each had a special duty to see that the curtains were snapped on swiftly and securely. What a luxury some years later to have a 'closed car' in which one could simply roll up the glass window!"

Another nursing home resident, Kathy, told her e-pals about living in rural Nebraska in the early part of the 20th century. She had many chores on her family's farm, and would receive a quarter "if I was lucky" on special Saturday nights, no more than once or twice a month, when she could get into town. How did she spend her allowance? Kathy described going to the "outdoor the-

ater" – not a drive-in, but a movie projector and screen set up right on the sidewalk in Crete.

Such exchanges have helped build students' knowledge and information about the history of our community and its people, says Jana Fulton, a fourth-grade teacher at Crete Elementary School. The children have returned the favor. Students in Fulton's class created a webpage to "show and tell" their e-pals about themselves; they took digital pictures of each other, loaded them into a computer word-processing program and wrote short paragraphs telling about their individual interests. Later, they had an opportunity to meet their e-pals in person at a reception arranged by Access for a Better Crete.

"We not only used cutting-edge technology, we also found the hearts and souls of those with whom we communicated," says Fulton. "From nine-year-olds to 70-year-olds (and beyond), we all feel a greater sense of community."

For some people, the opportunity to meet someone like Kathy alone justifies a project like Access for a Better Crete. The indefatigable resident of Centennial Terrace nursing home got a new lease on life with the computer, and she grabbed it with zest. Besides corresponding with students, she uses email to keep in touch with her family, publishes a newsletter for her nursing home, and prints greeting cards for fellow residents of her nursing home. She also conducts web searches for fellow nursing home residents. Kathy suffers from muscular dystrophy, and can only type with one finger. But she spends so much time at the computer the finger gets worn out. When that happens, she types with her knuckles.

VALLEY CITY, NORTH DAKOTA:
TAKING A BROADER LOOK AT LOCAL ISSUES

Valley City, ND
Project Starting Date:
October 1, 1997
Project Ending Date:
January 31, 2000
Total Project Cost:
$247,378
Federal Share:
$123,368

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While kids in Nebraska are using a computer network to overcome the isolation that exists within their communities, some students in North Dakota are using technology to surmount isolation between communities.

Eastern North Dakota is a region with many towns, but they all are part of a single drainage basin. Almost every community faces a water-resource issue. Each town's problem is a little different, though. In Devils Lake, the problem is rising water: for at least 15 years, the lake that gives the town its name has been rising, threatening both the city and surrounding private and tribal lands. Communities to the south, meanwhile, must cope with regular floods on the Sheyenne River, and the repeated threat of property damage, river-bank erosion and pollution. The Sheyenne, in turn, flows into the Red River, which has its own annual cycle of flooding; the river suffered a major flood in 1997, with disastrous consequences for the city of Grand Forks.

Though seemingly separate, these diverse issues are intricately intertwined. Efforts to find a comprehensive solution have been bedeviled by the different interests of different communities. In the city of Devils Lake, for instance, the Devils Lake Emergency Management Committee has been explor-

ing the idea of building an outlet that would drain some of the water from the overflowing lake into the Sheyenne River. That would help solve the Devils Lake problem, and also would be an economic boon to the Tate Topa Indian tribe in nearby Fort Totten, whose main highway access to the outside world has been flooded by rising lake waters.

The Devils Lake idea sounds simple, but there's a problem: people who live along the Sheyenne fear water drained from Devils Lake would increase the threat of flooding in their downstream community. They also worry that lake water, which is higher in salinity than the river water, might harm plant and fish life in the river. So some Valley City people have formed "People to Save the Sheyenne" to fight the proposed drainage plan. Meanwhile, people along the Red River, which runs north into Canada along the border between North Dakota and Minnesota, also worry about flooding. Water quality also is an issue for them, since the Red is the major source of water for Grand Forks.

In 1995, two teachers launched a water quality research project designed to turn the Red River Basin into a living laboratory for their classes. Instead of spending all their time studying textbooks or repeating canned experiments dreamed up for them, the students studied regional water issues, met with local officials, and even went out to collect and analyze their own water samples. The teachers joined forces with Valley City State University's Center for Innovation in Instruction, to take a step that could be a model for the divided communities of the Red River Basin: since water is a regional issue, they asked, why not study it on a regional basis?

The result is the Red River Basin Water Research Project. Eight schools, from Devils Lake to Drayton on the Red River near Canada, joined forces to study the region's interconnected water issues. At different intervals during the year, students collect water from various sites throughout the drainage system and test it for phosphates, salinity, acidity, presence of dissolved oxygen and carbon dioxide, transparency, and temperature. Some also gauge water flow rates. They record this field data on laptop computers.

Then, they share their results. Each of the eight schools has a multimedia computer linked to the Internet, and each has digital image and video cameras. They exchange some data on a project web site or through email. Teachers post announcements and ask a "question of the week" on a listserv (an email address list) that goes out to all the participating classrooms. Each classroom also has its own email account, so that individual classrooms can communicate separately with each other.

For the middle school students in the project, all this has been a heady mix of science, geography (the Center for Innovation in Instruction purchased a global positioning unit for students to use in determining the exact location of their water testing sites), social studies, and communications. "Ever since I started teaching 25 years ago, all my kids did was cookbook labs," says Mike Watterson, a middle school science teacher at Valley City Junior High School. "Now, they're out in the field, collecting data and bringing it back with them to analyze. It's actual science."

Information-sharing among schools has produced some interesting results. Students in Drayton, for instance, took videotapes this past year of deer trapped on a island by high water, giving downstream kids a vivid idea of how flooding affects the area near the Canadian border.

Students in West Fargo, meanwhile, produced a videotape and pictures of bank erosion in a trench designed to divert flooding Sheyenne River waters from their town. They also researched the cost of repairing such damage. Kids in Devils Lake used that information in their own study of the water-diversion idea. And downstream in Grand Forks, students jumped on the idea to explore whether a water diversion program would protect their city from destructive floods, such as it suffered in 1997. The Grand Forks students, in turn, attended a city council meeting on the issue in their town, reporting via email to the other schools regarding what transpired.

Watterson's students in Valley City, for their part, took pictures of the spillway on the Bald Hill Dam, which is designed to control water flow along their section of the Sheyenne. The pictures showed various flow rates – ranging from 100 to 12,000 cubic feet per second – to give fellow students an idea how much water might flow from Devils Lake. Separately, students in Lisbon, another town on the Red River, analyzed how rising waters on the Red might require different water-treatment methods in their town.

To top off each semester's work, students from all the participating schools meet via a videoconference using the North Dakota Interactive Video Network. This spring, students from each school posed questions to their peers in other school, a process that resembled real life much more closely than any traditional exam (and was much more fun). The conference required students to know their material and think on their feet – challenges teachers say they handled with aplomb.

Teachers believe students came away from the project with a sense of the complexity of issues and an understanding of how their lives are interconnected with those of other people in the region. Chantel, a seventh-grader at Eastwood Elementary School in West Fargo, says she changed her mind about the Devils Lake water diversion as a result of her participation in the project. "Before, I thought they (the people in Devils Lake) should just move, but then I learned the city is so big and they've been there so long that it would be hard," Chantel says. "Now, I think the outlet is a good idea."

In many respects, the schools in eastern North Dakota have come a long way. "Now they know you can do things with a computer rather than play games," says Watterson. "You can share tons of information, pictures, set up listservs – all this was brand new to them, and now they're comfortable with it."

But in other ways, there is nothing new about the project. Children have always been an integral part of community life in rural areas like eastern North Dakota. The school calendar, for instance, is built to ensure that children will be available to help in planting and harvesting. And even today, when flood waters rise in Valley City, children leave school at the sound of the town siren and go to the river to fill sandbags.

PART THREE:

KIDS CONTRIBUTING TO THEIR COMMUNITIES

ROGERS AND HOLLAND SCHOOLS:
COMMUNITY SERVICE LEARNING IN TEXAS

Third graders at Holland Elementary School in Holland, Texas, saw a problem in their community that needed fixing: each day, children on their way to school from a newly-built subdivision had to cross a busy street without a traffic light. To the students in Paula Unberhagen's and Renee Marshall's classes, it seemed like an accident waiting to happen.

So the kids sprang into action. First, they emailed an official in the state highway department who was responsible for street-crossing safety. He explained what legal requirements had to be met before the department could install a traffic light. Then, they went to the Internet to find a street map of Holland, which they cropped to show just the relevant streets in the neighborhood of the school. Using the map, they designed a survey, which they sent to all the students in the school to determine how many children used the troublesome crossing. They also staked out the crossing, counting the number of cars that drove by during the hours just before and after school. To meet other highway department concerns, they analyzed Holland's streets to determine whether school children could get to school along a safer, alternative route. They interviewed school board members to determine whether the school administration would establish a bus route for children who used the crossing.

The students concluded that the intersection qualified for a traffic light under the highway department's standards. Department officials were duly impressed. After confirming the children's findings, they installed a traffic light. But there is more: the third graders then used graphics software to create a coloring book explaining street-crossing safety for kindergarten students, and they prepared PowerPoint slides to accompany a presentation they gave on the same topic to older kids. On top of all that, they won permission from a local grocery store to paint public-service advertisements on grocery bags to dramatize the issue for adults.

Welcome to "Kids as Agents of Change," an innovative program that has won the Holland School District and nearby Rogers School District a national reputation as leaders in the use of information technology in education. As the street-crossing safety project

Rogers and Holland Schools
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and scores of others like it demonstrate, computers and computer networks are breaking down the walls between schools and their communities. With these new tools, kids are tackling real-life problems, gathering raw information from numerous sources, working with experts outside their classrooms, and developing powerful new skills to communicate what they have learned.

Educational reformers say that such "authentic" learning experiences cultivate the skills that students need in today's rapidly changing society – skills such as critical thinking, problem-solving, collaboration and communication. What's more, they say these tools could serve as a great potential equalizer, giving children in less populated rural areas and inner cities access to the same educational opportunities as those in larger and more affluent communities.

The Rogers and Holland school districts lie in Bell County, a low-income, rural area about half way between Austin and Waco. But they have attracted national attention. Business Week magazine recently cited them as leaders in the innovative use of technology in primary and secondary classrooms. It's easy to understand why; in recent years, their students have generated literally dozens of eye-catching projects. Consider some other examples:

- After surveying grocery store customers, interviewing store managers and scanning the Internet, a group of seventh graders produced ten tips for saving on grocery bills. A local newspaper printed their suggestions.

- Third, sixth and seventh graders jointly produced a study on what wild animals migrate through their county, and then reported their findings in a brochure and presentation to local civic groups.

- Another group of kids studied the problem of stray animals. Working with an official at the Waco Humane Society, they created a "virtual animal shelter" – a webpage where people could find pets in need of adoption. They also designed an educational board game, which they used to teach elementary school kids and residents of a senior citizens home about the issue.

- In 1997, students in Holland extensively tested the local water supply, and demonstrated that there is a close correlation between the incidence of tooth decay and the amount of fluoride in different communities' water. They devised their research in consultation with a pediatric dentist based in Washington, DC. When the student project ended, the city government decided to carry on the testing itself.

- A group of teenage girls worked with an endocrinologist to study the dieting habits of adolescent girls. Their surveys showed the problem was much worse than most people believed. "They did an in-depth presentation – they went everywhere, class-to-class, club-to-club, to Scott and White [Hospital in Temple]," recalls Carol Ann Bonds, superintendent for the Rogers School District. "Kids and community groups invited them to speak. They just flooded this community with what they had learned."

- Other students, with advice from doctors at Scott and White Hospital, showed that state health statistics, which are collected county-by-county, masked a surprisingly high incidence of neurological birth defects and other health problems in the rural parts of Bell county. Officials had assumed that the problems were concentrated in Killeen, the largest city in the county, but in fact, some conditions occur more often on a per capita basis in other parts of the county. That finding brought doctors from Texas A&M University, which has established a center for rural health, to the school in Rogers, asking to use the students' database. "They were blown away," says Paul Resta, a professor of instructional technology at the University of Texas. "These secondary school kids had done a significant body of research."

The projects at Rogers are examples of what educational reformers call "student-centered learning." Instead of memorizing what they hear in lectures or read in textbooks, and instead of repeating canned science experiments, the students start by identifying real-life problems. Then, they devise their own strategies for collecting, analyzing, and using data. In this approach, teachers do not impart a specific set of facts to children; rather, they help students develop skills to find answers to their own questions.

The process is not as free-form as it may sound. At the Rogers and Holland schools, projects must meet numerous prerequisites. Students must use the scientific method – identifying a problem, forming a hypothesis, collecting and analyzing data, and drawing conclusions. They are required to use email to consult with outside experts. They must collaborate with other students, preferably in other classrooms or even other schools. They must prepare presentations – generally using PowerPoint software, digital cameras and other technologies – to describe their findings. And they must devise a plan of action for putting their research to work. Each year, they present their projects to a panel of judges, including professors at the University of Texas.

Technology is a crucial component in all projects, school officials say. If it weren't for email, few mentors could give as much time as the school expects (mentors are asked to communicate with kids at least once a week during the projects). Access to the World Wide Web gives students an opportunity to collect current information on current issues – something that often cannot be found in textbooks or school libraries. Moreover, Internet access changes the role of teachers. They do not have to be the source of all information and all wisdom; instead, they can serve as guides who help students find and assess the information they need to answer their own questions.

"Without the Internet, the [street-crossing safety] project would have been a teacher-led project," says Cindy Gunn, principal at Holland. "It wouldn't have been student-led."

Rogers and Holland schools also are at the forefront of efforts to use videoconferencing in education. They have held conferences to describe projects with students as far away as New York and Florida. Last year, eleventh and twelfth graders from Holland collaborated with students in Mexico City to study

ethnic stereotypes. Students in the two countries conducted surveys to determine what impressions their peers had of each other's country. After analyzing the results, they held a videoconference to compare notes. "It got rough for a while," says Gunn, recalling that Americans were offended that many Mexicans assumed that Americans "like to party" and used "lots of drugs," while the Mexicans were upset at the assumptions that they were poor, uneducated, and lazy. During the conference, it became clear that the Mexican students generally were more affluent than the kids from Texas, and were quite well educated, too – most were fluent in English, while few of the Americans could carry on a conversation in Spanish.

But for all its importance, technology is not an end itself. Teachers stress that students should use whatever tools are appropriate – high-tech, low-tech, or no tech. "Our goal is that technology be invisible," explains Bonds. "It's what the kids doing with it that's important."

Still, Bonds takes considerable satisfaction that kids from rural Texas are at the forefront of the movement to use information technology in education. "One of the great disadvantages our kids have had in going to outstanding universities is that they are not prepared for diversity," she explains. "Coming from a one-light town, they are not aggressive enough about showing their skills. But technology makes our kids bullet proof. Now, they will storm into major institutions."

TECH CREWS: *COMPASSIONATE TECHNICIANS IN MISSISSIPPI*

When Amanda was admitted to the Blair E. Batson Hospital for Children in Jackson, Mississippi, last year, she faced an ordeal that would depress even the most cockeyed of optimists. The 16-year old had leukemia, and she needed a bone marrow transplant. Because of the danger of infection, she would have to spend as many as 100 days in an isolation room, cut off from all outside contact. Even books would have to be passed through an autoclave – a pressurized steam-heated vessel used for sterilization – before being sent into her room.

But Amanda nevertheless found a link to the outside world. Her room had a small computer, and within hours of settling into her isolated new world, she already was receiving email messages from a group of fellow students at Winona Junior-Senior High School, who kept her up on the latest teen gossip. Despite her illness, she also was able to correspond with her teachers, who sent her notes and some work. She went on the Internet to research a term paper on AIDS. And, her fellow students even supplied her – again via the Internet – some games to play (she couldn't even take board games into her room because of the strict sterility requirement).

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"I don't know what I would have done if I didn't have email and contact with the outside world," says Amanda. Whether because of the computer link or her own spirit, Amanda made a remarkable recovery. Although the doctors had warned her to be ready for a hospital stay of at least six to eight weeks, she was discharged after just five and a half weeks.

The students who gave Amanda her lifeline were members of Winona High's "tech crew," a group of students trained to install and operate computer networks. But if you think that description makes them sound like a group of "nerds," think again. For Amanda and many other hospitalized children, the tech crews have been kind and helping friends. Since the fall of 1998, they have made it their personal mission to offer an electronic helping hand to every child admitted to the hospital, a wing of the University of Mississippi Medical Center. In the process, they are learning something about computers far beyond wires, routers, switches, and servers; they are learning what purpose computers can serve.

Tech crews originally were established in the mid-1990s to address two concerns. Amid growing national support for the idea of wiring classrooms, many Mississippi school districts, especially ones in rural areas, lacked technical experts who could build and maintain computer networks. Besides hampering the schools' ability to offer the most up-to-date education, this lack of a work force skilled in computer networking came to be seen as a factor limiting economic development in many Mississippi communities. By training high school students in basic computer-networking skills, officials at the Mississippi Department of Education sought to create a local pool of experts who could wire schools, train teachers and other students, and maintain networks. At the same time, officials hoped this would give rural areas a trained cadre of information-technology professionals who could support modern industry.

Tech crews initially were established in five school districts. They now operate in 42 schools, and more are coming on board every year. The participating students receive training in networking, web page development and tele-

communications. Then they go to work. Many tech crew members, who are paid a starting wage of $6 an hour, have wired their own schools, and they played a big role in "NetDay" efforts to connect other schools and classrooms. Today, with an increasing number of schools coming online, their services remain much in demand. A growing number of schools have taken advantage of the special "e-rate" – discounted telecommunications services required under the Telecommunications Act of 1996 – to come online; as a result, the demand for training, trouble-shooting and maintenance of school networks is growing. "There's a groundswell," says Robin Sutliff, senior program analyst for the Mississippi De-

partment of Education. "I'm getting call after call from schools that want to set up tech crews."

While trying to help school districts meet this demand, the department also has moved to enrich training opportunities for tech crew members. In particular, it enlisted in the Cisco Academies program, which provides a web-based curriculum, backed up by hands-on experience, in networking and router configuration. Cisco Systems, a leading manufacturer of routers, designed the training program for much the same reason Mississippi school officials established tech crews: it noted that efforts to introduce computer networking in schools were hampered because teachers were either reluctant or too busy to learn how to use the new technology. The four-semester program provides more extensive training than tech crew members received previously. Students who pass a final test at the end of the program can receive an entry-level certification in networking – good enough to qualify them for jobs paying salaries around $30,000 or $40,000 in Mississippi.

The children's wing at the University of Mississippi Medical Center seemed a logical project for the tech crews. It has 130 beds spread among a pediatric intensive care unit and four other floors. The hospital employs five teachers who attempt to keep hospitalized kids current in their studies. But it is a struggle, given the widely divergent ages and academic needs of patients. Department of Education officials have described the hospital ward as analogous to a rural, one-room school trying to make its way in a world of modern electronic classrooms.

Officials concluded that computers might give hospitalized kids a better chance of keeping up academically. Tech crews stood ready to wire the pediatric wing, but the hospital's information services department balked at letting them do the job. So volunteers from BellSouth worked with the hospital to do the job, installing computers in patients' rooms and establishing a separate email account for each patient.

But while computers could give patients a conduit to the outside world, who would be waiting on the outside to communicate with them? The tech crews willingly filled the void. First, they established a listserv linking them to the hospital; each day, a teacher at the hospital would send a note to all tech crew members reporting who had been admitted and who had been discharged that day. Tech crew members then contacted patients, offering some badly needed friendship and sympathy.

In no time at all, the wires were abuzz. "They talk about proms, dates, football games – the things kids want to know about," says Michelle Revord, a teacher-supervisor in the hospital's pediatric wing. "It is absolutely wonderful. The kids love it."

Tech crew members also created a webpage for hospitalized students. Its opening page is a picture of a school. After clicking on the front door, users find themselves in a hallway with a series of options. The "library" offers a range of web-based education services. Another door enables users to send an email message to the Department of Education requesting a tutor. In the "mailroom," hospitalized patients can create a personalized email greeting card to send to a

friend. The "gym" is full of web links to sports pages. And, oh yes, there is a "recess" door full of games.

Teachers in the hospital's school say the computer links have enabled a number of hospitalized students to keep up with their studies. One high schooler was able to use the Internet to find answers for an economics worksheet, for instance. Another was able to use spread sheets at the same time his class was learning how to use them. And another college-bound high school girl enrolled in a junior college course. Many high school juniors and seniors are now able to use the Internet to conduct research on virtually any topic imaginable; in the past, they had to confine their research papers to medical topics since they only could use the hospital's library. Revord predicts the network will become increasingly useful as more teachers in regular high schools start to use email and become more comfortable teaching students at remote locations like the hospital.

But it is the actual conversation – the human contact – that patients seem to value most. On mornings when Amanda was too sick to get out of bed, she asked her mother or hospital staff members to read her the email messages that had come in overnight. And often, to the surprise of medical experts, she forced herself out of bed to answer these messages in the afternoons.

Other patients seemed to benefit as well. Hospital staff members have long observed a phenomenon they call the "sunset syndrome" – a tendency for many patients to feel more pain at dusk, when visiting hours are over and they have fewer distractions. But with email to send or receive, sunsets seemed less painful in the children's wing. One doctor was excited to read a 16-year-old's description of the Crohn's Disease that afflicted her. Up to that point, he hadn't known whether she understood her illness. But her description was so accurate, that he now uses it to explain the sickness to other kids.

Of course, hospitalizations don't always end happily. When one popular patient died of cystic fibrosis, Revord says, the tech crews knew about it even before she did. Students flooded the listserv with questions and comments, asking how they could contact the girl's mother, pondering the loss of a friend. "One young man wrote a page and a half about friendship," says Revord. "They were providing support to each other."

That may not have been the purpose of the hospital project initially, but it was worthwhile, says Ellen Davis Burnham, technology specialist for the Mississippi Department of Education. "To come to know someone, even via email, to share their innermost thoughts, to pray for their full recovery, and then to lose

them – it has made the tech crews grow in many ways never considered in the grant," she says. "They have come to appreciate their own lives and families, and even to find a new joy in their school life."

PART FOUR:

GETTING READY FOR THE WORLD OF WORK

BOSTON PUBLIC SCHOOLS:
COLLABORATIVE LEARNING IN NEW ENGLAND

School is supposed to prepare kids to enter the job market, but that is getting to be a bigger and bigger challenge.

For one thing, schools generally have little connection to the organizations that one day will employ their graduates. In addition, most schools operate in a manner utterly unlike today's workplaces: while employers increasingly look for employees who can work in self-directing teams, most students and teachers work independently, in isolation from each other. And far from encouraging kids to be self-starters and risk-takers, schoolwork often is an exercise in passiveness, with students mostly performing rote exercises based on information they are handed in lectures and textbooks.

In 1996, the Boston public school system set out to create a smoother school-to-career transition for its students. Using technology, it proposed building closer ties between classrooms and area employers. In the process, it planned to turn the traditional formula for organizing classrooms upside down. Students would work collaboratively, not alone; teachers would plan their curriculum in consultation with each other and with employers; and students would learn by tackling real-world issues, not by performing exercises that seem to have little to do with the communities they live in today or the jobs they hope to hold in the future.

The instrument of this change would be a computer network. With it, students and teachers would be able to collaborate with each other and with organizations based in the surrounding community. Many educational reformers said this is a better way to teach – and few would disagree with the argument that this would convert the school experience into something more closely resembling the world of work.

"Network for Student Success," as the project was known, linked six Boston high schools and eight community-based organizations. Each received a networked computer lab with ten workstations. In addition, the project developed an on-line workspace where students, teachers and individuals in the community organizations could share each other's work and ideas. Working together, the

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$650,000

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teachers and community-based organizations came up with some compelling projects for students. Three of the projects give a sense of the results:

- Students at East Boston High School worked with the East Boston Health Center in designing a new cafeteria for the school. The students conducted a nutrition survey among fellow students, translating it into Spanish for Hispanic students. They went on-line to research the history of federal lunch program requirements, and gathered more nutrition information from the neighborhood health center. They also taught students at a nearby elementary school about nutrition.

- Students at Dorchester High School researched the history of welfare and the impact of welfare on their community. After receiving training from officials at the Dorchester YMCA, the students helped the organization plan a community job fair, where they then showed community members how to write resumes and use a computer job bank.

- Students at Madison Park Technical/Vocational High School worked with on-line mentors from Bell Atlantic to learn about fiber optics, while students at El Centro del Cardenal, a community-based organization that runs an alternative education program for high school students, learned about webpage design. Then, kids from the two institutions got together and trained each other in what they had learned.

Besides learning some specific skills – how to write a resume or design a webpage, for instance – the students developed other skills increasingly in demand in the work world. Consider a project involving students at Brighton High School and the Crittenton Hastings House, an alternative education program for pregnant teenagers and teen fathers. The students had to collaborate in creating a community garden at Crittenton. One set of students got the job of testing the soil, while another had to document the proposed garden plot's sun exposure. Both groups put their data in graph form, and posted it on-line. Yet another class then took this data, and after consulting via email with a horticulturist, decided which plants to buy.

"They had to learn the skill of communicating information in an understandable form to somebody else who needs it to complete a project," says Felicia Robb, TIIAP grant coordinator for the Boston Public Schools. "That's what the business world is all about."

Teachers say they see big changes in some of the students who use computers to engage in projects like these. "Once I get them in here, I have them hooked," says Sandra Simpson, a high school history teacher who is in charge of the computer lab at Dorchester High School. Unlike the typical classroom, where all attention is focused on the teacher, students work independently in computer labs. But this actually creates a spontaneous form of cooperation. "Kids help each other. This is a place where kids are experts, [where] you have peers coaching peers," Simpson says. "There are very few places in the school where kids get to help other kids."

Simpson says one of the biggest changes she has seen in student performance involves writing. "It takes a kid a step back – if he sees his writing on a screen, he is more likely to take on the role of editor," she notes. "And the idea of making revisions and new drafts makes a whole lot more sense because they can do it with ease."

If anything, teachers have been affected even more profoundly. Teaching traditionally has been a very isolated profession. Teachers spend most of their time in classrooms or supervising students, making it very difficult to consult with each other or with parents, let alone establish the kind of community connections that can make a school-to-career program click. But the new workspace designed as part of the TIIAP project is changing that.

The "intranet" has three major parts – a "personal" section, where individuals can do their own work, write their rough drafts, put down their raw data, and start to whip it into shape; a "team" space, where members of specific teams can share their product and collectively work to prepare it for other teams; and a "community" space, where everybody participating in the project can share finished products, news, and general ideas.

The shared workspace was only completed near the end of the TIIAP project, but it has caught on with teachers. Under a "Challenge Grant" from the U.S. Department of Education, teachers in the Boston Public Schools and in others in suburban Watertown, Massachusetts, are building on the concept to create an electronic working space where they can collaborate on projects. Some of its new features will include a "web tour," where teachers can organize web links for students. The web tour software, which is very easy to use (teachers can master it in five minutes, according to Alice Santiago, director of the challenge grant project), allows teachers to send sets of web links to students, complete with comments or questions about individual websites.

"The idea of getting teachers to collaborate with a commitment to how they teach is very powerful," Santiago says. The project trained 250 teachers last year, and is adding 170 more this year. Besides training teachers, Santiago says, it plans to draw parents and community-based organizations into closer collaboration in coming years.

"What was unthinkable before is now thinkable," says Robb. "We're blowing out the walls of the school. No longer are teachers constrained by the confines of the classroom."

CORPORATION FOR BUSINESS, WORK, AND LEARNING: *TELEMENTORING FOR ACADEMIC AND CAREER SUCCESS*

A suspicious-looking person emerges from a fast-food establishment, and promptly encounters two policemen. He quickly stuffs something into his mouth, and starts running. The police give chase, and when they catch him they discover illegal drugs in his mouth. Was this a legitimate arrest?

Cindy Burns, who teaches social studies at Brockton High School in Massachusetts, presented this hypothetical situation, based on an actual court case, to a group of high school freshmen last year. She was teaching the class about the Fourth Amendment to the U.S. Constitution, which limits police search and seizure powers. But this was no abstract classroom exercise. Thanks to an email partnership with the Brockton Police Department, the kids exchanged their thoughts on the subject with six officers and detectives. (Just as the court had ruled in the actual case, the Brockton police officials said the arrest in Burns' case study was not legitimate because the police lacked probable cause that a crime had been committed.)

Burns' class was a pilot project in an ambitious new effort to use technology to forge closer links between employers and schools. "Connections for Learning," as the TIIAP project is known, seeks to bring together 180 teachers, 4,000 students and 180 adult volunteers over the Internet. Volunteers representing institutions ranging from banks to police departments will answer questions from students, and help them complete projects that demonstrate the real-world applications of their classroom studies.

The project is the brainchild of the Corporation for Business, Work and Learning (CBWL), a publicly-chartered non-profit agency that supports workforce development and education reform. As the corporation sees it, connecting students to mentors to address real-world issues serves several interrelated purposes. From a purely academic point of view, it stimulates and challenges many students who are not inspired by traditional classroom exercises. It also helps motivate students to prepare for the world of work by introducing them to people engaged in careers that might interest them. And it helps students develop the skills they will need for the jobs of tomorrow, which increasingly require workers who can apply academic skills to solve problems.

Educators have long recognized these potential benefits from mentoring, but serious barriers have stood in the way. Teaching traditionally has been an isolated profession, and few teachers have experience working with employers to connect curriculum to workplace applications. Employers are not particularly geared up to work with schools either. Few can afford the time or resources to host student interns on-site. Employees rarely have structured time to meet with students, and school schedules make it difficult for students to spend much time in workplace internships.

"We know that high-quality work-based learning is a key to enhancing student achievement, but we need to give employers a way to connect with schools that is easy, effective, and fits within their demanding work sched-

Connections for Learning
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$1,041,162
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$499,940

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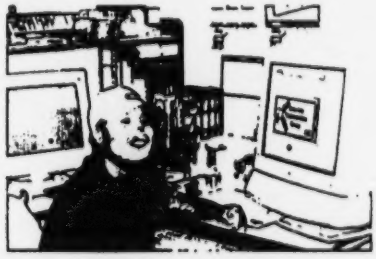
www.cbwl.org/

ules," says Charles Goldberg, program manager for the corporation's Center for Youth Development and Education.

Technology provides an answer. Using e-mail, mentors can work closely with students free of scheduling hassles or time-consuming travel. The idea is not exactly new. Employees of Hewlett-Packard Company, among others, have engaged in it for some years. But the Corporation for Business, Work and Learning hopes to organize telementoring on a large scale, bringing in a wide variety of mentors to deal with large numbers of students. In addition, the corporation's "Connections for Learning" TIIAP-sponsored project is designing a program more structured – and more geared to meeting specific curriculum objectives – than most traditional ones. To that end, it plans to link all its projects directly to state educational and testing standards spelled out in the Massachusetts Curriculum Frameworks and the Massachusetts Comprehensive Assessment System.

"Research indicates that on-line mentoring seems to work best where you have a well-defined idea what the [mentoring] relationship is about, why you have developed the relationship and what the learning objectives are," explains Goldberg.

Dealing with large numbers of students while setting high standards for mentoring relationships are not easy tasks. To routinize the process of linking mentors to students, CBWL uses MentorCenter, a Web-based software program supported by the Learning Communities Technology Group at Boston College. The program is remarkably easy to use. With even minimal familiarity with computers or the Internet, teachers can design projects, build relationships between mentors and students, and monitor student progress. The software has also been used by Educational Testing Services to help master teachers train other teachers in student assessment practices, by graduate music students to mentor high school students in music composition, and by graduate students at LeMoyne College to teach local middle and high school students. A demonstration of MentorCenter can be found at the following website: **lss.ocmboces.org**.



Of course, a mentoring program is only as good as the mentors who participate in it. Finding high-quality mentors and connecting them with teachers requires skilled intermediaries. In the Massachusetts project, that job falls to key contact people at the local level, seven of whom are connected with another CBWL-managed project called "Communities and Schools for Career Success" entrepreneurs. "You have to have somebody on the scene who has the time and ability to coordinate all the pieces and make it happen – who can get the teachers and the mentors," says Goldberg.

Goldberg concedes that setting up the program has been more time-consuming and complicated than expected. But he and others involved in the project are convinced it will prove to be worth the effort. Cindy Burns, the Brockton High School social studies teacher, says talking with police opened her kids' eyes. Before participating in her Fourth Amendment class, most of her students had formed their impression of police work from television. It was, she believes, a distorted perception. "On television, you don't see police as people that think," she says. "You see them always taking action. But the students saw that police work actually requires a great deal of thought and perceptiveness."

After discussing the hypothetical search-and-seizure case, one student said he was surprised to learn how much police need to know about the law. Another, after continuing an email correspondence with one police officer, learned that policemen actually have to write a lot, interview people, talk to people in social service agencies, and learn how to express themselves clearly and concisely (in court appearances, for instance.).

"He said, 'Wow, I didn't know there was this much behind it,'" Burns recalls the student saying.

To Burns, whose students in the pilot program all had been identified as being at-risk for school difficulties, that alone was an important success. "The forum they were using was exciting to the kids," she says. "And they were getting a more realistic picture of what they will need to succeed in careers."

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PART FIVE:

HELPING CHILDREN BRIDGE THE DIGITAL DIVIDE

PLUGGED IN:
TEEN ENTREPRENEURS IN SILICON VALLEY

When the Community Technology Foundation needed somebody to design its website, it turned to an up-and-coming Silicon Valley operation known as Plugged In Enterprises. The foundation, which was created in 1997 to promote universal access to emerging telecommunications networks, is happy with its choice.

"They give me a 24-hour turn-around on any updates," says a satisfied Micki Burton, manager for external affairs at Pacific Bell, the major unit of the new telecommunications company. "They are very professional."

The twist to this story is that Plugged In Enterprises is not just any web-design firm. It is a group of teenagers from East Palo Alto, California. That's in Silicon Valley, but it's on the other side of the proverbial tracks from the concentration of companies and educational institutions that form a hub of the Information Revolution. Nevertheless, the teens from Plugged In are showing that kids from lower-income and ethnically diverse communities are just as eager as their middle-class counterparts to take part in the modern information society – and, if given a chance, just as adept at using its technological tools.

"Although many people in our community may be characterized as 'disadvantaged,' in a number of ways, there is an incredible pool of talent here," says Magda Escobar, Plugged In's executive director.

Plugged In Enterprises is part of Plugged In, a thriving community technology center that also includes Plugged In Greenhouse, an after-school program for younger kids; and the Technology Access Center, where people of all ages come to use the Internet for myriad purposes – homework, researching school papers, creating personal websites, writing resumes, looking for jobs, checking email, and, in a few instances, running small businesses. The three programs are all integral to Plugged In's overall goal of spreading information-age tools to an area that has the lowest per-capita income in its county and whose unemployment rate is five times higher than neighboring Palo Alto's.

Plugged In
Project Starting Date:
October 15, 1995
Project Ending Date:
April 14, 1997
Total Project Cost:
$440,350
Federal Share:
$192,995

Contact:
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mescobar@pluggedin.org
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Once clearly ensconced on the wrong side of the digital divide, some kids in East Palo Alto are now right at the forefront of the cyber generation – and not just in behind-the-scenes jobs like web design. Students from Plugged In attracted national attention a few years ago as hosts of a popular teen chat group on America On-line. That evolved into "On the Line," which is said to be the largest teen content site on the Internet. With six content areas and a staff of 60 teenage volunteers from around the country, On the Line has an estimated 80,000 to 120,000 users.

While Open Voice focuses on "content creation" by youths, Plugged In cultivates skills that will help teens find their way in today's high-tech labor market. Plugged In Enterprises was launched in 1996, as a for-profit arm of Plugged In, and not the recipient of federal funds. Plugged In Enterprises has designed websites for numerous clients, most of them small organizations in East Palo Alto that previously did not have Internet connections or websites. Its most significant early project was Epa.net, a community information clearinghouse that provides a weekly calendar of events, city council meeting agendas, local job listings, links to community colleges, a digital bulletin board, local business listings, city government information, and websites for more than 18 community-based, non-profit organizations.

Participation on the production team is an honor that students must earn. Each quarter, Plugged In Enterprises recruits nine students to participate in a 10-week training program that covers computer basics, graphic design and Adobe Photoshop software, and HTML scripting. While Plugged In staff members manage the classes, professionals from some of Silicon Valley's best-known companies and organizations, including Wired, Intel Corporation, Crystal Dynamics, Stanford University School of Education, Cisco Systems, Macromedia and Sun Microsystems, volunteer their services. After that, the students serve one-month internships working with Plugged In Enterprises' production team. Those who show improved technical skills, a willingness to learn employment skills and a desire to improve themselves become eligible to be permanent members of the team – a paying job.

Production-team operations combine continuing education with a taste for how the real world of business works. Students typically work every day after school, from 4 p.m. to 7 p.m. On Mondays, Tuesdays and Thursdays, the team focuses on production work. On Wednesdays, students receive advanced

training. And on Fridays, they take field trips to Internet companies in Silicon Valley, where they catch up on the latest developments in the field and talk to professionals about career options. All along the way, the team members are held to rigorous standards, much as they would be if they already had full-time jobs. "They are evaluated by their supervisors, critiqued by their clients, and forced to keep abreast of new developments in the field," says Escobar. "Their pay is dependent on their skill level and their ability to transfer their skills to their peers both on the production team and off." (As part of their jobs, they must train clients in basic computer and Internet skills, and individuals cannot advance until they become proficient in a new web-page design tool and train a peer to use it.)

If the contract to design a website for the Community Technology Foundation is any indication, the hard work and high standards are starting to pay off. The $28,000 contract is the most lucrative yet for Plugged In Enterprises. The job was so big that the after-school teenagers had to hire a professional web design company to serve as a junior partner in the project. That company persuaded the teenagers, who were accustomed to performing their work at low rates as a community service, to raise their prices.

Plugged In Enterprises still has its eyes fixed on the long-term gains rather than a quick pay-off, though. Many teens who work there still do so at a financial loss; in California's tight labor market, they could earn more working in fast food restaurants. As for the partnership with a professional firm, Plugged In officials were more interested in learning than in profits.

"What we wanted was mentoring and an understanding of their business infrastructure," says Escobar.

NATIONAL URBAN TECHNOLOGY CENTER: *INNER-CITY KIDS LEARNING ABOUT COMPUTERS AND LIFE*

National Urban Technology Center
Project Starting Date:
October 1, 1996
Project Ending Date:
September 30, 1998
Total Project Cost:
$1,048,334
Federal Share:
$399,703

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What role should computers and computer networks play in addressing the needs of troubled inner-city youth? That's a tough question. On one hand, the relative lack of computer networks in low-income neighborhoods threatens to add a troublesome new dimension to inequality in America at a time when these tools are becoming essential to economic success and participation in the nation's social, cultural and political life. But on the other hand, some analysts worry that computer projects drain badly needed resources that low-income urban communities could use to greater advantage in other areas.

A TIIAP-funded project in the Bedford-Stuyvesant neighborhood of Brooklyn, New York, offers a distinctive perspective on this debate. Inner-city kids, it suggests, need both computers and a wide range of other services. What's more, its sponsors believe that if computer training is integrated with other services aimed at children at-risk, the results can greatly exceed what computers or more traditional services could accomplish alone.

The project is the Community Employment Network, which, among other things, has installed a computer lab linked to the Internet at Concord Community Services, an agency that seeks to help foster children. The National Urban Technology Center, Inc., a non-profit corporation dedicated to building technology skills and infrastructure in inner-city communities, offers kids at Concord a comprehensive curriculum designed to help them acquire both technology skills and social skills that will enable them to enter the American mainstream.

The project has its work cut out for it. Bedford-Stuyvesant's foster care youth represent one of the most troubled populations in one of the nation's most troubled communities. Fully 71 percent of the people living in the neighborhood are under the age of 18. Of these youth, 64 percent are on public assistance, nearly two-thirds live in female-headed households, and fewer than half can read or perform math at grade level. One in every ten kids in the community is a known victim of abuse or neglect, giving the community one of New York's highest rates of children placed in foster care. Not surprisingly, drug dependency, teen pregnancy and school dropout rates are high, and the employment outlook for youth is typically limited to minimum wage jobs.

The National Urban Technology Center brought considerable experience with computers and education to its relationship with Concord Family Services. Since 1997, it has established 16 computer learning centers in 13 cities under the U.S. Department of Justice "Weed and Seed" program. The Urban Technology Center installs the learning facilities, which include five interconnected student stations and a teacher station capable of handling the most up-to-date software. It also trains community members to become certified community technology trainers.

The center's work with Concord Family Services underscored the need to integrate computer learning with efforts to improve the social skills of disadvantaged foster children, says Patricia Bransford, co-founder of the center. The result was creation of the Youth Leadership Academy, a 180-hour training program that intertwines computer learning with development of social skills (120 hours of classroom training, plus 60 hours of on-the-job training). Consider the program's various elements:

- A life-skills component. Students must participate in educational or vocational training, and those who are 16 or older must seek summer jobs. Students also are taught personal care and hygiene, basic nutrition and homemaking skills. They must develop knowledge about community resources, and they are taught how to budget money, open and use bank accounts, and shop wisely.

- A computer fundamentals component. In this part of the program, students learn basic Internet skills, word processing, how to use spreadsheets to analyze and display data, web publishing, how to use PowerPoint software, and computer maintenance. Upon completion of the program, students have basic skills in how to use the computer. Most also know how to take a computer apart, identify its parts and how they work, and diagnose computers that do not work.

- A school-to-work component. Students are introduced to the world of work through computer simulations. They work together to run a simulated bank or hotel, for instance, gathering and analyzing information related to revenues, expenses, profits and losses. Through the simulation, they identify problems, evaluate solutions, make decisions and then learn about the consequences of their actions.

- An independent computer projects component. Students apply their computer, critical-thinking, reading, and writing skills in a variety of projects. For instance, some use the Internet and CD resources to track down answers to questions presented on the National Urban Technology Center's web site. In another project, students use an on-line news service to read news stories, and they go to the Internet to see how different news organizations cover the same event. Students also create a monthly school lunch menu based on the U.S. Department of Agriculture's Food Guide Pyramid, and they use a spreadsheet to calculate the number of servings required in each food group.

Are computers essential to the kids' learning? Perhaps not, but they do have powerful advantages. According to Bransford, computers "excite" children. They allow kids to learn at their own pace, they provide instant feedback on student work, and they are available 24-hours a day, seven days a week (as part of the program, each student receives a refurbished home computer to practice and refine skills learned in class).

In addition, computer simulations offer a safe environment for kids who are tentative about their social interactions. "Computers don't holler at them if they make a mistake," says Lelar Floyd, director of Concord Family Services. "They just tell them they made a mistake and should go back and try again."

Floyd said she has had some surprises since forming the partnership with National Urban Technology. "One thing that surprised me was that the youngsters' reading skills have gone up to the point where some of them are almost up to grade level," she says. "We didn't start the program to increase their reading skills, but it has. They like the program and the way it's presented to them. It's forcing them to read."

The Youth Leadership Academy is not a "panacea," Floyd says. Some students do not buy into the structured and disciplined program. But of the roughly 80 children enrolled in Concord Family Services at any given time, about 50 agree to participate. And Floyd sees a big change in these students' attitudes and behavior. "Before, they didn't see much positive," she says. "Now they see the positives and the negatives, and they're working to do something to erase the negatives." Gary Simpson, pastor of Concord Baptist Church, agrees. He says the program is giving children a sense of empowerment – a belief they have marketable job skills and an ability to participate more fully in society. "Information is going to be the currency of the 21st century," notes Simpson. "I found Urban Technology work to be very different from other programs in that young people have lasting skills and impressions about their ability to be involved in the information world."

LAPTOP KIDS:
GETTING COMPUTERS INTO THE HOMES OF LOW-INCOME FAMILIES

"Falling Through the Net: Defining the Digital Divide," the National Telecommunications and Information Administration's third report on access to telecommunications technology, tells a stark story: Households with income over $75,000 are more than five times as likely to have a computer at home, and are more than seven times as likely to have Internet access, as those with income under $10,000.

As connectivity increasingly becomes an important determinant of success in school, in the workplace, and in the cultural and social life of the nation, this gap represents a major challenge. But how are we to overcome it? Two school districts in Minnesota tried tackling the issue head-on, providing laptop computers, family-based training and ongoing technical support to 110 low-income fourth graders and their parents in five schools.

Project sponsors were still working on a final report at press time, but focus group discussions conducted with parents, children and principals in June, 1998, suggest the project was a success. According to Cheryl Lange, the evaluator who led the discussions, students who received the computers subsequently showed increased self-esteem and motivation. These translated directly into improved academic performance. Students reported that they were using the Internet to get information, said they felt smarter, read more, and said that their study skills had improved. They said homework was now fun, according to Lange. Principals and parents agreed, reporting that the children got better grades, were more interested in learning, and spent less time watching television after the project began. According to the adults, the kids started taking pride in their work because they now could turn in papers and projects that looked as good as those produced by other students who had computers in their homes.

That pride manifested itself both in the kids' schoolwork and in their attitudes toward their computers, which they treated with considerable care. Of 130 laptops used in the project, only three were abused by kids, according to Steve George, director of planning and technology for one of the districts. (In two other cases, parents found themselves in such dire straits they pawned their computers in order to pay their rent. The project director reports that the computers were recovered by the school district and put back into circulation.)

George believes the project also improved things for parents. "That was one effect we hadn't expected," says George. Some parents said their job situations improved, either because they were able to perform their customary tasks more effectively or because they were promoted or were able to pursue new job opportunities as a result of the computer training they received through the project. Parents also said they felt more confident in dealing with their children. Principals confirmed this change, noting that the parents generally began participating more in parent-teacher conferences.

Laptop Kids
Project Starting Date:
October 1, 1997
Project Ending Date:
July 1, 1998
Total Project Cost:
$750,309
Federal Share:
$374,760

Contact:
Mr. Ray Queener
Independent School District #196
Technology Support Department
14445 Diamond Path
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www.isd196.k12.mn.us/tlap/

With children and parents both doing better, family life improved as well. "We heard over and over again how parents were working with their kids at home," says George. The project consciously forced that at first, requiring parents to participate in the training with children. But by all accounts, many families went beyond what was required. Voluntary training sessions offered later in the project were filled up. Often, when parents couldn't come with their kids to the sessions, siblings or grandparents came. One family, whose father had to spend much of the year in North Carolina, said email had held members together during the separation. A principal reported to Lange that school bus conversation seemed to change; kids who previously emerged from the bus discussing crises within the home or neighborhood now came off the bus talking about computer or technology issues.

Before the project began, some feared the project's requirement that participants be low-income would stigmatize the children. But according to Lange, the effect turned out to be exactly the opposite. Students felt special being involved in the project, and parents discussed how having the computers had leveled the playing field so that their children could compete with middle-class kids.

"Many reported that the project was a life-changing experience for them," she concluded. "It opened a world they did not know existed or if they did know, they did not believe would ever be open to them. Children and parents discussed how the project made them feel equal – that they had what people of affluence had in their homes."

Despite the project's obvious success, the two school districts do not plan to continue it now that their federal funding has expired. The reason is simple: cost. The laptops cost $2,500 each, and the school districts employed two full-time trainers. A number of teachers thought the schools faced higher priorities, according to George, and the districts felt they couldn't justify the expenditure without outside support.

There are cheaper ways to accomplish the same objective, however. The National Urban Technology Center's Youth Leadership Academy provides refurbished computers to students and their families as part of a comprehensive educational program (see page 29). Like the Minnesota school officials, Urban Technology requires active parental involvement in its project. But the center uses donated computers, and spends on average about $200 per computer to bring them up to standards. Overall, that 180-hour program costs between $800 and $1,200 per

student, including the computer and a stipend that students receive for serving an internship with an area employer. "At the end of the day, computers don't add that much to the cost," says Patricia Bransford, the co-founder of Urban Technology.

The benefits that low-income families reap by having computers in their homes far exceed the costs, says Lelar Floyd, executive director of Concord Family Services in Brooklyn, New York. But, she says, many families in her neighborhood believe computers are more expensive than they really are. While some poor families truly cannot afford even inexpensive computers, others can – provided they know the actual cost and see the benefits. "Some of them have big-screen televisions," she notes. "I try to compare costs for them."

One argument that resonates with many low-income parents in urban areas, she says, is that computers offer kids a safe way to learn about the outside world. "A lot of parents are afraid to let their kids out on the street in some of the areas they live in," Floyd says. "So the kids are learning about things through technology. They're able to go to different parts of the world that most of them will never get to."

Whatever means are found of increasing household ownership of computers, people who have worked with low-income families on technology projects feel some urgency about the issue. "We hope we have demonstrated that we have to provide better access to technology to those who can't afford it," says school technology director George in Minnesota. "I don't know the best mechanism for doing it, but the need is there, and the results can be very positive."

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CONCLUSION

During the National Telecommunications and Information Administration's 1998 "Networks for People Conference," Michael Schrage, research associate at the Massachusetts Institute of Technology Media Lab, proposed a standard for evaluating new networking technologies. Ultimately these new tools should be judged, he said, not by the quantity of information they hold or the speed with which they transmit it, but by whether they improve the quality of human relationships. As Schrage put it, "The most important product of the network is the networker. The real impact of these technologies is not about information, it's about the quality of relationships."

This report has applied Schrage's test to technology and children, exploring how networking tools are offering kids opportunities to form an array of meaningful and rewarding relationships. It has described how grade-school kids and senior citizens are learning from each other in Nebraska, and how high school students are sharing ideas with adult mentors in New England. It has told about young children in Texas who are making their communities better places to live, and about teenagers in Mississippi who are extending a helping hand to hospital patients. It has explored how children from Vermont to California are learning new ways to express themselves through music and other arts, and how kids from North Dakota to Massachusetts are learning to collaborate and communicate. Finally, it has discussed how dedicated people from coast-to-coast are striving to ensure that the opportunities of the new Information Society become available to the disadvantaged.

Together, the people described in this report make a compelling case that emerging information technologies can change children's lives for the better. But while technology is central to their vision, it is not the most important element. What most distinguishes these projects are the people who imagined them and who are now making them a reality. It is their belief in the dignity of individuals, their faith in families, and their commitment to communities that enable us to view our children's technological future with high hopes

APPENDIX:

PROJECTS FEATURED IN THIS REPORT

▲ Access for a Better Crete

Project Starting Date: October 1, 1996
Project Ending Date: September 30, 1998
Total Project Cost: $530,727
Federal Share: $240,911

Contact: **Ms. Sandy Rains**
Access for Better Crete
243 East 13th Street
Crete, NE 68333
(402) 826-4222
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www.creteabc.org/

▲ Boston Public Schools

Project Starting Date: October 1, 1996
Project Ending Date: July 31, 1998
Total Project Cost: $1,898,197
Federal Share: $650,000

Contact: **Ms. Felicia Robb**
Boston Public Schools
Technology Department
26 Court Street
Boston, MA 02108
(617) 635-9488
frobb@boston.k12.ma.us
dev.boston.k12.ma.us/PublicTiiap.nsf

▲ Connect-2-Tomorrow

Project Starting Date: October 1, 1997
Project Ending Date: January 2, 2000
Total Project Cost: $1,262,310
Federal Share: $625,000

Contact: **Ms. Ellen Davis Burnham**
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Office of Educational Technology
Center for Innovation
P.O. Box 771
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c2t.mdek12.state.ms.us/

▲ Connections for Learning

Project Starting Date: October 1, 1998
Project Ending Date: September 30, 2000
Total Project Cost: $1,041,162
Federal Share: $499,940

Contact: **Mr. Charles Goldberg**
Corporation for Business, Work, and Learning
529 Main Street
Charlestown, MA 02120
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www.cbwl.org/

▲ Laptop Kids

Project Starting Date: October 1, 1997
Project Ending Date: July 1, 1998
Total Project Cost: $750,309
Federal Share: $374,760

Contact: **Mr. Ray Queener**
Independent School District #196
Technology Support Department
14445 Diamond Path
Rosemount, MN 55068
(651) 423-7793
www.isd196.k12.mn.us/tiiap/

▲ National Urban Technology Center

Project Starting Date: October 1, 1996
Project Ending Date: September 30, 1998
Total Project Cost: $1,048,334
Federal Share: $399,703

Contact: **Ms. Patricia Bransford**
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▲ Plugged In

Project Starting Date: October 15, 1995
Project Ending Date: April 14, 1997
Total Project Cost: $440,350
Federal Share: $192,995

Contact: **Ms. Magda Escobar**
Plugged In
1923 University Avenue
East Palo Alto, CA 94303
(650) 322-1134
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▲ Rogers and Holland Schools

Project Starting Date: October 1, 1997
Project Ending Date: September 30, 1999
Total Project Cost: $748,999
Federal Share: $300,000

Contact: **Dr. Carol Ann Bonds**
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APPENDIX: PROJECTS FEATURED IN THIS REPORT

▲ Valley City, ND

Project Starting Date: October 1, 1997
Project Ending Date: January 31, 2000
Total Project Cost: $247,378
Federal Share: $123,368

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Center for Innovation in Instruction
101 College Street, SE
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pullen@sendit.nodak.edu
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▲ The Vermont Millennium Arts Project

Project Starting Date: October 1, 1998
Project Ending Date: September 30, 2001
Total Project Cost: $750,000
Federal Share: $375,000

Contact: **Ms. Dawn Ellis**
Vermont Council on the Arts
136 State Street
Montpelier, VT 05633
(802) 828-5425
dellis@arts.vca.state.vt.us
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▲ Zeum

Project Starting Date: October 1, 1997
Project Ending Date: September 30, 1999
Total Project Cost: $648,416
Federal Share: $239,062

Contact: **Ms. Marie Sayles**
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221 Fourth Street
San Francisco, CA 94103
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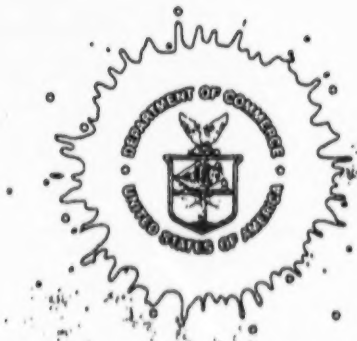
www.zeum.org/



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